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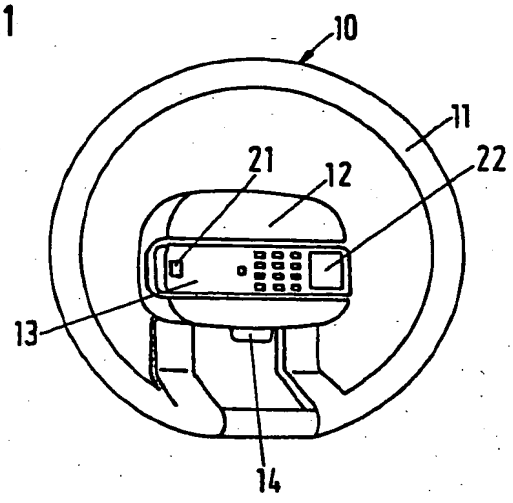
(54) A telephone system on a vehicle.

(57) A telephone system on the vehicle comprises a detachable handset including a microphone and speakers, a pad positioned near a vehicle driver for containing the detachable handset, an amplifiers for amplifying a voice signal from the microphone, a position detector for detecting a distance between the handset and the pad, and, a gain controller for controlling a gain of the amplifiers in response to the distance detected by the position detector.

When the handset is contained in the pad, the position detector detects that the handset is positioned near the pad. At this time, the gain controller increases the gain of the amplifiers, and consequently, the voices from the vehicle driver is clearly received. Therefore, a vehicle passenger especially the driver can use the telephone system under grasping a steering wheel with both hands.

When the handset is put off from the pad, the position detector detects that the hand set is positioned remotely from the pad. At this time, the gain controller decreases the gain of the amplifiers, and consequently, the vehicle passenger except for the driver can use the telephone system as same as a telephone system in a home.

Fig.1



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A TELEPHONE SYSTEM ON A VEHICLE

BACKGROUND OF THE INVENTION

This invention relates to a telephone system on a vehicle, and more particularly, relates to a telephone system including a detachable handset.

Recently, requirements for providing the telephone system on the vehicle are increased according to the development of the radio communication network for the vehicle. However, the same telephone system as in a home is used conventionally for the telephone system on the vehicle. Therefore, the conventional telephone system is not considered for uniqueness of the vehicle.

The telephone system on the vehicle becomes inconvenient for a vehicle driver if the driver can not use the telephone system while the driver is driving the vehicle. Further, the telephone system on the vehicle becomes inconvenient for vehicle passengers except for the driver, if the passengers can not use the telephone system in a manner as same as using the telephone system in their home.

Accordingly, it is preferable for the vehicle driver to execute an "on-hook talking" which enables to grasp a steering wheel with both hands. Further, it is preferable for the vehicle passengers except for the driver to execute a "off-hook talking" that enables to use the telephone system on the vehicle as same as the telephone system in the home.

Meanwhile, a talker's voice should be caught clearly over noises in the vehicle compartment in order to realize the "on-hook talking".

A telephone system that obtains both the "on-hook talking" and " the off-hook talking" is disclosed in Japanese laid-open patent publication No.82540/1986 published on April 26, 1986. This telephone system includes two microphones and two speakers. Especially, the microphone for the "on-hook talking" has a keen directivity in order to catch the talker's voice clearly.

A telephone system that obtains the "on-hook talking" is disclosed in Japanese laid-open patent publication No.141838/1980 published on November 6, 1980. This telephone system positions a microphone near talker's mouth in order to catch the talker's voice clearly under the "on-hook talking". This system catches the talker's voice closely from the talker's mouth if the "on-hook talking" is executed.

However, the two microphones increases the cost of the telephone system because the number of the parts is increased. Further, the two microphones makes the electronic circuit complicate because an electronic circuit is required to select and process voice signals from the two microphones. Thus, two microphones are not preferable for the telephone system on the vehicle.

Further, if the microphone is positioned near the vehicle passengers who wants to talk with, the passenger feels the unpleasantness from the microphone. Especially, when the driver wants to send the communication, the driver may not be able to concentrate the driving because the microphone may disturb the driver's sight.

SUMMARY OF THE INVENTION

Accordingly, it is an object of the present invention to obviate the above conventional drawbacks.

Further, it is an object of the present invention to execute both the "on-hook talking" and the "off-hook talking" with a common single microphone.

Furthermore, it is an object of the present invention to remove a microphone from a talker's mouth under the "on-hook talking".

To achieve the above objects, the telephone system on the vehicle according to the present invention comprises a detachable handset including a microphone and a speaker, a containing means positioned near the driver for containing the detachable handset, amplifying means for amplifying a voice signal from the microphone, position detecting means for detecting a distance between the handset and the containing means, and, gain controlling means for increasing a gain of the amplifying means in response to the distance detected by the position detecting means.

When the "on-hook talking" is going to be executed by the telephone system, the position detecting means detects that the handset is close to the containing means, i.e. the microphone is positioned remotely from the talker's mouth. Therefore, the level of the voice signal detected by the microphone becomes small. Accordingly, in the present invention, when the handset is positioned near the containing means, the gain controlling means increases the gain of the amplifying means.

Further,when the "off-hook talking" is going to be executed, the position detecting means detects that the handset is remote to the containing means, i.e. the microphone is positioned in close to the talker's mouth. Therefore, the level of the voice signal detected by the microphone becomes large. Accordingly, in the present invention, when the handset is remotely positioned from the containing means, the gain controlling means decreases the gain of the amplifying means.

Accordingly, in the present invention, both the

"on-hook talking" and the "off-hook talking" can be obtained with the common single microphone, and also, the microphone can be positioned remotely from the driver's mouth under the "on-hook talking".

Further objects and features of the present invention will be apparent from the following description referring to the accompanying figures.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 shows a perspective view of a telephone system on a vehicle according to the present invention.

Fig. 2 shows a rear perspective view of a handset according to the present invention.

Fig. 3 shows a front perspective view of a handset according to the present invention.

Fig. 4 shows a cross sectional view taking along line I-I in Fig. 2.

Fig. 5 shows a circuit diagram contained in a handset of the present invention.

Fig. 6 shows a circuit diagram of the microphone amplifier of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Fig. 1 shows a perspective view of a telephone system on a vehicle according to a preferred embodiment of the present invention.

A steering wheel (10) comprises a ring (11) and a pad (12). Further, the pad (12) has a groove (not shown). A handset (13) is contained in the groove. In this embodiment, the handset (13) is mounted on the pad (12) detachably. The handset (13) is put off from the pad (12) by pushing an eject switch (14).

In the telephone system according to this embodiment, an "on-hook talking" is executed when the handset (13) is mounted on the pad (12), which enables the vehicle passengers to talk over under driving a vehicle. That is to say, when the driver wishes to use the telephone system, the driver is able to use the telephone system under grasping the steering wheel (10) with both hands by mounting the handset (13) on the pad (12).

Further, in the telephone system according to this preferred embodiment, a "off-hook talking" is executed when the handset (13) is put off from the pad (12), which enables the vehicle passengers to talk over in a manner as same as in his/her home. That is to say, when the vehicle passengers wishes to use the telephone system, the passengers is able to use the telephone system as same as a usual telephone system in a home by putting off the handset (13) from the pad (12).

Fig. 2 shows a rear perspective view of the handset (13).

Microphone holes (15) for the "off-hook talking" and speaker holes (16) for the "off-hook talking" are opened on a rear surface (13a) of the handset (13). Further, a power switch (20) is disposed on the rear surface (13a). The power switch (20) connects an electronic circuit (25) contained in the handset (13) to a rechargeable battery (BTT) selectively in order to conserve the electric power of the battery (BTT) in the detached handset (13). Furthermore, contacts (17, 18, 19) are provided on the rear surface (13a). The contacts (17, 18, 19) receive an electric power from corresponding contacts (not shown) provided on the pad (12) of the steering wheel (10). The contact (17) receives the electric power for executing the "on-hook talking" from the pad (12). The contact (19) receives the electric power for executing the "off-hook talking". The electric power received by the contact (19) is saved in the battery (BTT) contained in the handset (13). The contact (18) is a common earth for both contacts (17, 19). Accordingly, when the handset (13) is mounted on the pad (12), the electric power is supplied from the pad (12) to the handset (13) through the contacts (17, 18, 19). When the handset (13) is mounted on the pad (12), the battery (BTT) is charged and a amplifier (AMP7) enables to operate.

Fig. 3 shows a front perspective view of the handset (13).

Microphone holes (21) and speaker holes (22) are opened on a front surface (13b) of the handset (13). Further, push buttons (23) and a hook switch (24) are provided on the front surface (13b) of the handset (13). The push buttons (23) are utilized for dialling a telephone number. The hook switch (24) is utilized for connecting the telephone system to the public telephone circuit.

Fig. 4 shows a I-I cross sectional view of the handset (13) in the Fig. 2.

At one end of the handset (13), a speaker (27) for the "on-hook talking" and a speaker (28) for the off-hook talking" are provided. The speaker (27) emits the voice toward the opposite direction against the speaker (28). That is to say, the speaker (27) for the on-hook talking" is contained in the speaker box (29) which includes the speaker holes (22) in order to emit the voice toward the front surface (13b) of the handset (13). Further, the speaker (28) for the "off-hook talking" is contained in the speaker box (30) which includes the speaker holes (16) in order to emit the voice toward the rear surface (13a) of the handset (13).

Furthermore, at the other end of the handset (13), a microphone (26) is provided. The microphone (26) is utilized commonly for both "on-hook

talking" and off-hook talking". The microphone (26) is contained in the microphone box (31) which includes the microphone holes (15) for the "off-hook talking" and the microphone holes (21) for the "on-hook talking". Both microphone holes (15, 21) are opened on opposite sides respectively.

The microphone (26) in this embodiment is a unidirectional microphone having a keen directivity. The directivity of the microphone (26) is pointed to the microphone holes (21) which is used in the "on-hook talking". In other words, the microphone (26) is more sensitive to the voice through the microphone holes (21) for the "on-hook talking" than the voice through the microphone holes (15) for the "off-hook talking".

The electronic circuit (25) is disposed in the handset (13). Further, the push buttons (23) and the hook switch (24) is fixed to the same key board (32).

Fig. 5 shows the circuit diagram in the handset (13).

The key board (32), the speakers (27, 28), microphone (26) and the power switch (20) are electrically connected to the electronic circuit (25) with conductive wires (not shown).

The electronic circuit (25) comprises a microphone amplifier (33), a dialler (34), a speaker driver (35), an on-hook talking controller (36), a transmitting and receiving circuit (37) and the rechargeable battery (BTT).

The microphone amplifier (33) is connected to an input terminal of the transmitting and receiving circuit (37) through the dialler (34). Further, the speaker driver (35) and the on-hook talking controller (36) are connected to an output terminal of the transmitting and receiving circuit (37).

The voice signal generated by the microphone (26) is applied to the dialler (34) after amplifying through the microphone amplifier (33).

Referring now to Fig. 6, the microphone amplifier (33) is explained.

The microphone (26) is connected to terminals (100, 101). Both amplifiers (AMP1, AMP3) are connected to the terminal (100). In this embodiment, gain of the amplifier (AMP1) is equalized with gain of amplifier (AMP3) by adjusting. Detailed explanation for the amplifiers (AMP1, AMP3) are omitted from the present specification because the amplifiers (AMP1, AMP3) are well known circuits in the art.

Further, an amplifier (AMP2) is connected to the amplifier (AMP1). Gain of the amplifier (AMP2) is established more than 1 by adjusting. In other words, the output voltage from the amplifier (AMP2) is always lager than the input voltage applied to the amplifier (AMP2). Detailed explanation for the amplifier (AMP2) is also omitted because the amplifier (AMP2) is well known circuit in the art.

The voice signal generated by the microphone (26) is amplified by two different channels at the same time. One channel includes the amplifiers (AMP1, AMP2) and the other channel includes the amplifier (AMP3). However, the channel including the amplifiers (AMP1, AMP2) amplifies the voice signal greater than the channel including the amplifier (AMP3). Because, the channel including the amplifier (AMP1, AMP2) has a greater gain than the channel including the amplifier (AMP3) with only the gain of amplifier (AMP2).

The amplifiers (AMP2, AMP3) is connected to a gain selector (GAIN). The gain selector (GAIN) comprises an analog switch (108) and an inverter (109).

Output signal from the amplifier (AMP2) is applied to a terminal (102) of the analog switch (108). Further, output signal of the amplifier is applied to a terminal (103) of the analog switch (108).

Both terminals (104, 105) of the analog switch (108) are connected to a terminal (112). The terminal (112) is connected to the dialler (34).

The analog switch (108) comprises two switching elements which turn on and off in response to the signal applied to the terminals (106, 107). One of the switching elements connects the terminal (102) to the terminal (104) selectively in response to a signal applied to the terminal (106), and the other of the switching elements connects the terminal (103) to the terminal (105) selectively in response to a signal applied to the terminal (107).

The terminal (106) of the analog switch (108) is connected to the contact (17) through a resistor (100) and is grounded through a resistor (111). Further, the terminal (107) of the analog switch (108) is connected to inverter (109). An input terminal of the inverter (109) is connected to the contact (17) through a resistor (110) and is grounded through a resistor (111) as same as the terminal (106) of the analog switch (108).

Accordingly, voltage on the terminal (106) of the analog switch (108) and voltage on the input terminal of the inverter (109) are substantially equal to voltage supplied by power supply when the handset (13) is mounted on the pad (12). Because, the electric power is supplied to the contact (17) from the pad (12). Further, both voltage on the terminal (106) and the input terminal of the inverter (109) becomes grounded level when the handset (13) is put off from the pad (12).

Therefore, the analog switch (108) connects the terminal (102) to the terminal (104) when the handset (13) is mounted on the pad (12). Contrary, the analog switch (108) connects the terminal (103) to the terminal (105) when the handset (13) is put off from the pad (12).

The gain of microphone amplifier (33) can be controlled by the analog switch (108) for selecting

the two independent channels.

Referring again to Fig. 5, the dialler (34) is explained.

The dialler circuit (34) is a circuit for converting a telephone number into Dual Tone Multi-Frequency (DTMF) signal. The dialler (34) comprises a DTMF encoder (ENC1) and a attenuator (ATT1). When the push buttons (23) are operated, the dialler (34) attenuates the voice signal from the microphone amplifier (33), and instead of the voice signal, the dialler applies the DTMF signal in accordance with the operation of the push buttons (23) to the transmitting and receiving circuit (37). Further, when the push buttons (23) are not operated, the dialler (34) supplies the voice signal from the microphone amplifier (33) to the transmitting and receiving circuit (37).

The transmitting and receiving circuit (37) comprises a modulator (MOD1), a transmitter (TX1), demodulator circuit (DEM1), receiver (RX1) and antenna (ANT1). The modulator (MOD1) and transmitter (TX1) convert the voice signal from the dialler (34) into an electric wave. The demodulator (DEM1) and receiver (RX1) convert an electric wave from the telephone controller (38) into the voice signal which is supplied to the speaker driver (35) and the on-hook talking controller (36). The frequency of electric wave transmitted by the transmitter (TX1) is different from the frequency of the electric wave received by the receiver (RX1). Accordingly, the transmitting and receiving circuit (37) is able to transmit and receive the electric waves at the same time without mutual interferences.

The voice signal from the dialler (34) is converted into the electric wave by the transmitting and receiving circuit (37). Then, the electric wave transmits to the telephone controller (38) through the antenna (ANT1).

Meanwhile, the electric wave from the telephone controller (38) is converted into the voice signal by the transmitting and receiving circuit (37). Then, the voice signal converted by the transmitting and receiving circuit (37) is supplied to the speaker driver (35) and the on-hook talking controller (36).

The speaker driver (35) comprises three amplifiers (AMP5, AMP6, AMP7). The speaker (28) for the "off-hook talking" is connected to the amplifier (AMP6). The speaker (27) for the "on-hook talking" is connected to the amplifier (AMP7). The amplifier (AMP6) amplifies the voice signal from the amplifier (AMP5), and then, drives the speaker (28) for the "off-hook talking". Further, the amplifier (AMP7) amplifies the voice signal from the amplifier (AMP5), and then, drives the speaker (27) for the "on-hook talking".

By the way, the amplifiers (AMP6, AMP7) are supplied the electric power by the different power supply. That is to say, the amplifier (AMP6) is supplied the electric power from the battery (BTT). The amplifier (AMP7) is supplied the electric power from the pad (12) through the contact (17). Accordingly, if the handset (13) is put off from the pad (12), the amplifier (AMP7) can not operate.

The on-hook talking controlling circuit (36) comprises an amplifier (AMP4), a DTMF decoder (DEC1), a bi-stable latch (LAT) and a power supply controller (PSC). When a predetermined signal are received from the telephone controller (38), the on-hook talking controller (36) decodes the signal by the decoder (DEC1) and memorizes the decoded signal in the bi-stable latch (LAT). The latch (LAT) of the present embodiment is able to memorize 1-bit of binary signal. The power supply controller (PSC) is connected to the bi-stable latch (LAT).

The power supply controller (PSC) is a switching circuit interposed between the contact (17) and the amplifier (AMP7). The power supply controller (PSC) controls the power supplying from the pad (12) to the amplifier (AMP7). Accordingly, the operation of the amplifier (AMP7) is determined by the condition of the bi-stable latch (LAT).

Meanwhile, a regulated power supply (REG1) and excessive charging prevention circuit (REG2) are contained in the pad (12). The regulated power supply (REG1) is connected to the battery (not shown) mounted on the vehicle body. Further, the excessive charging prevention circuit (REG2) is interposed between the regulated power supply (REG1) and contact (19). The contact (19) is connected to the power switch (20) and rechargeable battery (BTT) respectively. The battery (BTT) is charged while the handset (13) is mounted on the pad (12) through the contact (19).

An operation of the electronic circuit (25) is explained.

When the telephone system on the vehicle is called by an telephone system out of the vehicle, i.e. when an bell contained in the telephone controller (38) rings, the hook switch (24) is operated by the vehicle passenger in order to contact the telephone system to the public telephone circuit. The hook switch (24) is also operated by the vehicle passenger when the passenger wishes to use the telephone system.

When the hook switch (24) is operated, the DTMF signal corresponding to the operation of the hook switch (24) is generated by the dialler (34). Then the operation of the hook switch (24) is converted into the electric wave by the transmitting and receiving circuit (37) and is transmitted to the telephone controller (38).

When the operation of the hook switch (24) is transmitted to the telephone controller (38), the telephone controller (38) transmits the predeter-

mined signal to the handset (13). Then, if the handset (13) is mounted on the pad (12), the on-hook talking controller (38) is operated and the amplifier (AMP7) enables to operate.

Further, when the operation of the hook switch (24) is transmitted to the telephone controller (38), the telephone controller (38) connects the handset (13) to a public telephone circuit. At this time, the telephone system on the vehicle executes the "on-hook talking".

Thus, when the handset (13) is mounted on the pad (12), the amplifier (AMP7) is operated in response to the operation of the on-hook talking controller (38). Further, the microphone amplifier (33) is established in high gain. Because, the electric power from the pad (12) is supplied to the contact (17). Accordingly, while the handset (13) is mounted on the pad (12), the telephone system according to this embodiment executes the "on-hook talking automatically.

Contrary, when the handset (13) is put off from the pad (12), the amplifier (AMP7) does not operate entirely. Further, the microphone amplifier (33) is established in low gain. Because, the electric power from the pad (12) is not supplied to the contact (17). Accordingly, while the handset (13) is put off from the pad (12), the telephone system according to this embodiment executes the "off-hook talking" automatically.

As mentioned above, the telephone system on the vehicle according to this embodiment comprises the detachable handset (13) including a microphone (26) and speakers (27, 28), the pad (12) positioned near the driver for containing the handset (13), the amplifiers (AMP1, AMP2, AMP3) for amplifying the voice signal from the microphone (26), the contacts (17, 18) for detecting the distance between the handset (13) and the pad (12), and, the gain selector (GAIN) for increasing the gain of the amplifiers (AMP1, AMP2, AMP3) in response to the distance detected by the contacts (17, 18).

Accordingly, the microphone (26) is utilized commonly for both the "on-hook talking" and the "off-hook talking". Therefore, the electronic circuit (25) is simplified, and thus, the low cost telephone system is provided.

Further, according to this embodiment, the microphone (26) is able to be positioned remotely from the driver's mouth under the "on-hook talking". Therefore, the driver may concentrate the vehicle driving.

Further, even if the vehicle stops rapidly, i.e. if the driver is forced to be pressed to the steering wheel (10), the driver may be safe because the handset (13) is mounted on the pad (12).

A telephone system on the vehicle comprises a detachable handset including a microphone and speakers, a pad positioned near a vehicle driver for containing the detachable handset, an amplifiers for amplifying a voice signal from the microphone, a position detector for detecting a distance between the handset and the pad, and, a gain controller for controlling a gain of the amplifiers in response to the distance detected by the position detector.

When the handset is contained in the pad, the position detector detects that the handset is positioned near the pad. At this time, the gain controller increases the gain of the amplifiers, and consequently, the voices from the vehicle driver is clearly received. Therefore, a vehicle passenger especially the driver can use the telephone system under grasping a steering wheel with both hands.

When the handset is put off from the pad, the position detector detects that the hand set is positioned remotely from the pad. At this time, the gain controller decreases the gain of the amplifiers, and consequently, the vehicle passenger except for the driver can use the telephone system as same as a telephone system in a home.

Claims

(1) A telephone system on a vehicle comprising:

a detachable handset including a microphone and a speaker;

containing means positioned near a driver for containing said detachable handset;

amplifying means for amplifying a voice signal from said microphone,

position detecting means for detecting a distance between said handset and said containing means; and;

gain controlling means for increasing a gain of said amplifying means in response to said distance detected by said position detecting means.

(2) A telephone system on a vehicle according to claim 1, wherein said handset comprises;

a first speaker for emitting a voice loudly;

a second speaker for emitting a voice in a whisper; and;

a selecting means for selecting one of said first and second speakers.

(3) A telephone system on a vehicle according to claim 1, wherein said containing means comprises:

a steering wheel;

a pad portion provided on a centre of said steering wheel; and;

a groove provided on said pad portion.

(4) A telephone system on a vehicle according to claim 1, wherein said amplifying means comprises:

a first channel for amplifying said output signal

of said microphone with a first gain; and;

a second channel for amplifying said output signal of said microphone with a second gain.

(5) A telephone system on a vehicle according to claim 1, wherein said position detecting means comprises;

a first contacting means provided on said handset; and;

a second contacting means provided on said containing means for contacting said first contacting means and supplying a electric power to said handset.

Fig.1

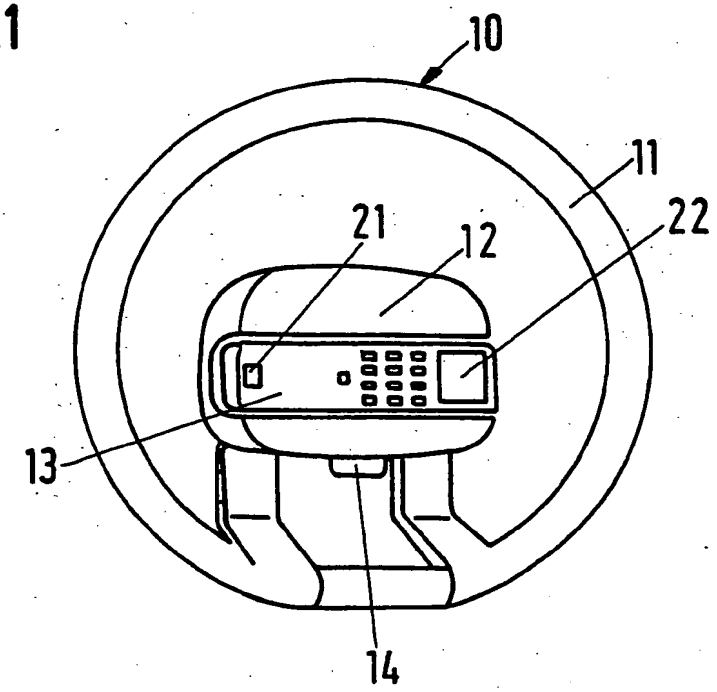


Fig.2

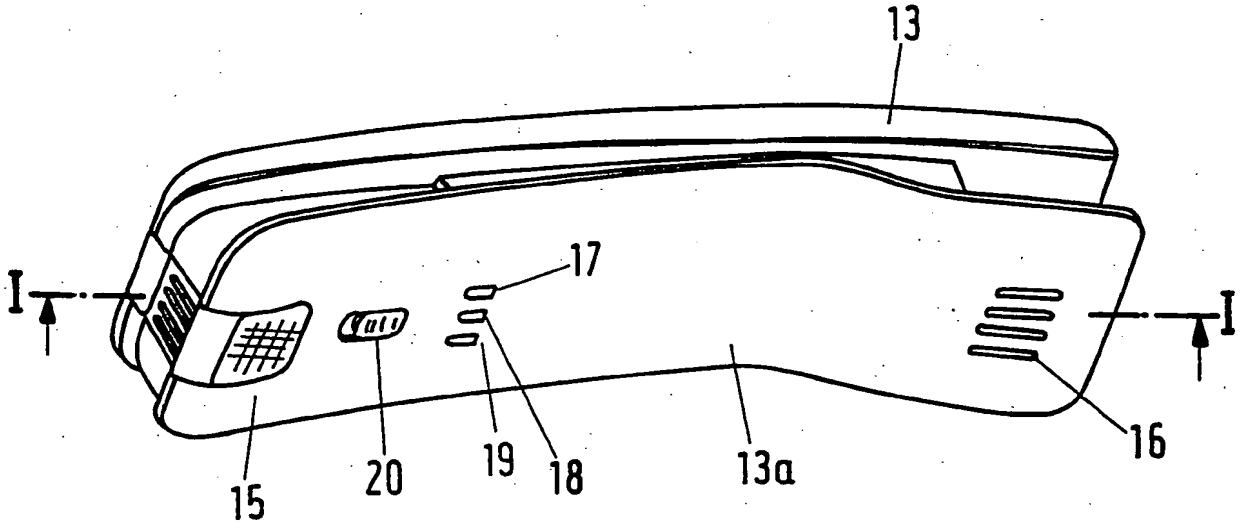


Fig.3

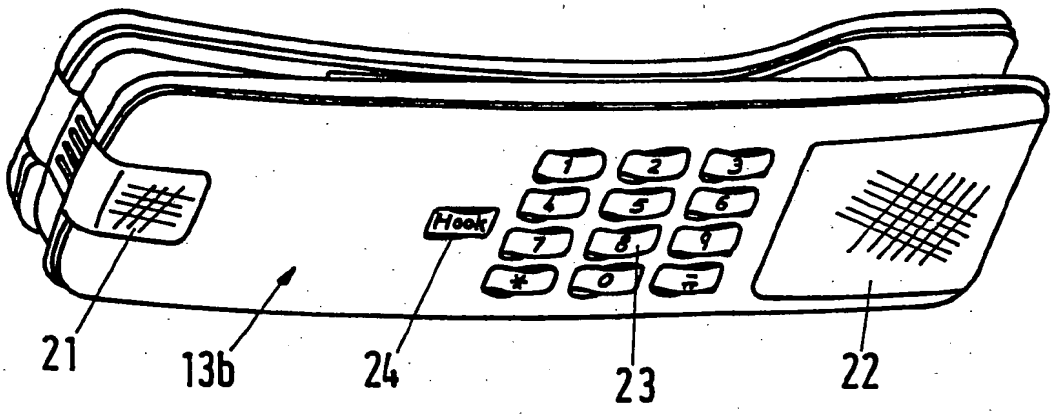
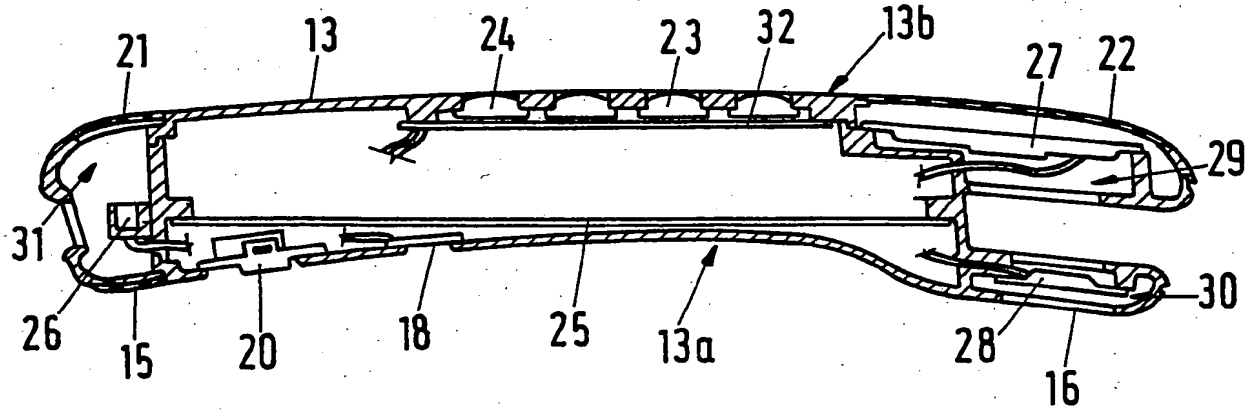

Hook
21
13b
24
23
22

Fig.4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13a
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Fig.5

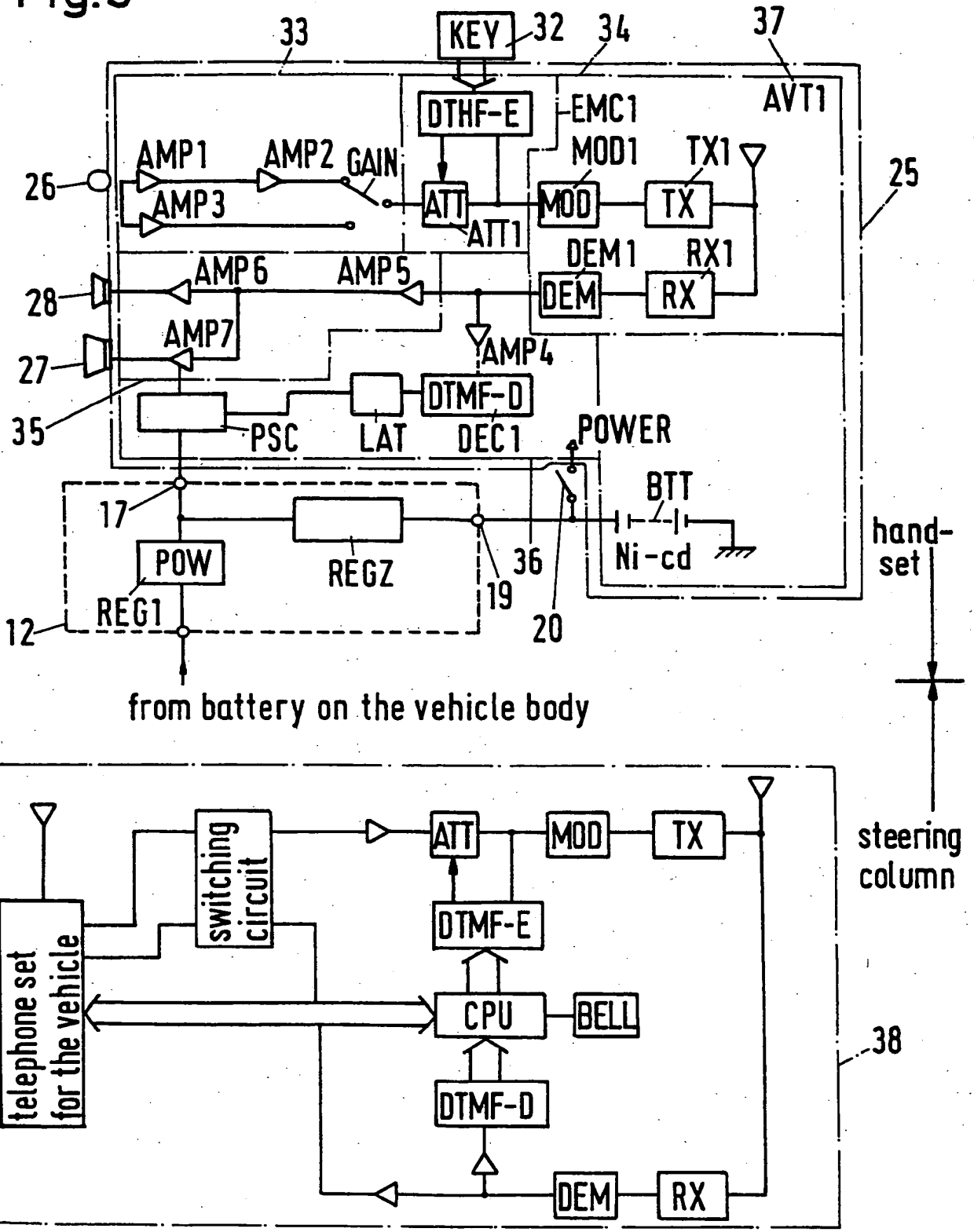
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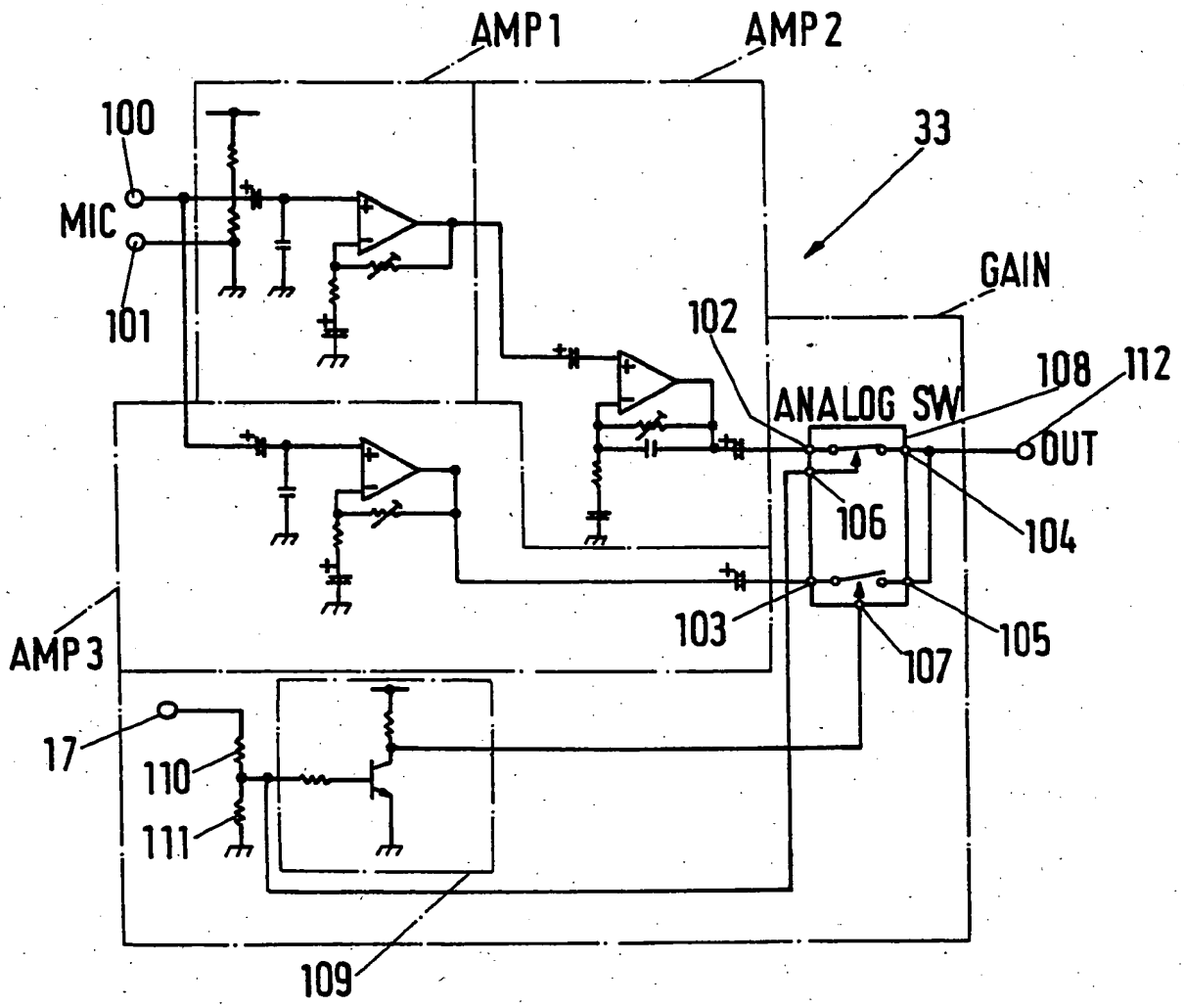
Fig.6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